Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Analysis of Load Rate Dependence of Neuronal Soma Using Atomic Force Microscopy ELISE SPEDDEN, Tufts University Department of Physics and Astronomy, MAXIM DOKUKIN, IGOR SOKOLOV, Tufts University Department of Mechanical Engineering, CRISTIAN STAII, Tufts University Department of Physics and Astronomy — Surfaces of biological cells are covered with a layer of molecules (glycocalyx) and membrane protrusions (microvilli and microridges). This so-called "brush" layer plays a distinct role in the measured elastic modulus of cells. We utilize atomic force microscopy (AFM) to study mechanical properties of the soma and brush layer of live rat cortical neurons. The elastic modulus of the soma and brush are measured for cells indented at different AFM probe loading rates, ranging from 1-10 μm/s. The cells were studied at both 37 °C (near-physiological temperature at which microtubules dominate high stiffness regions in the soma) and at 25 °C (reduced temperature state at which actin components dominate high stiffness regions in the soma). If one uses a model with no brush taken into account, the derived elastic modulus shows the rate dependence similar to the one reported previously in the literature. Using the model with brush, we observed no statistically significant rate dependence of the elastic modulus of the soma, whereas the effective brush length demonstrates strong rate dependence. These measurements yield insight into the mechanical reaction of living neurons to externally applied stresses.

Elise Spedden
Tufts University Department of Physics and Astronomy

Date submitted: 13 Nov 2013 Electronic form version 1.4